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Some of the best evidence on the inheritance of acquired characters has been too recent, perhaps, for consideration in this edition. Unless we are much mistaken in the next edition this section will chronicle the greatest advances in the theory of evolution.

As for Mendelism the treatment given by Plate is all too brief, though appreciative. He entertains the view that the Mendelian result follows between closely related individuals but not between distinct species; between the latter the characters blend. This conclusion seems to the reviewer insufficiently founded; the cross between a goldfinch and a canary shows in the first generation no more blending of characters than that between two races of canaries. The method of inheritance probably depends less on the degree of relationship of the individuals crossed than upon the nature of the characters concerned.

Of the book as a whole one can speak only in praise. Notwithstanding its conservative attitude, it affords, in the reviewer's opinion, the best général résumé extant of modern evolutionary data and theories; there are other excellent résumés but, for the most part, now out of date. How quickly a book on this topic may become out of date is indicated by the growth of the bibliography in the successive editions of Plate's book. In the first edition there were about 210 titles; in the second, 260; and in the last 450. The new edition will be widely read, but it deserves the greater accessibility that an English translation would give. In any case it seems well adapted to hold its ground, for some time to come, as the standard treatise on Darwinism.

CHAS. B. DAVENPORT

The Fossil Turtles of North America. By OLIVER PERRY HAY. Carnegie Institution. Pp. 568, pls. 113. 1908.

The appearance of Dr. Hay's extensive and richly illustrated memoir upon the fossil turtles of North America will mark a new departure in the study of this important and interesting order of reptiles. A bulky volume of nearly six hundred pages and over one hundred plates, aside from the numerous text

illustrations, it will enable the student, for the first time in many years, to understand and appreciate the material at his command, for there are few collections of extinct vertebrates in America which do not have some remains of turtles. We may now expect a rapid increase in our still very defective knowledge of these animals, since but very few of the 276 species described in the present work are completely known; indeed, much the larger part are yet imperfectly known. The author, after the examination of nearly all the types, as well as most of the known material in America, has systematized and correlated our present knowledge so that the work will serve as the basis of the literature for future studies.

The reviewer has read attentively the extended and detailed introductory parts of the volume on the structure, classification, geographical and geological distribution and evolution of the Testudinata, and for the most part has only commendation and approval. But he can not approve the classification that Dr. Hay adopts. The division of the order into two chief groups or suborders, the Athecæ and Thecophora, first proposed by Dollo and Cope, has been carried to an extreme by the author, in that he would have the former a primitive branch from the testudinate stem, arising in early Trias or late Permian, and all its aquatic adaptations and chelonid resemblances purely of parallel origin; an hypothesis difficult to accept. He assumes that the primitive turtles possessed two dermal coverings, an inner represented by the carapace and plastron of ordinary turtles, an outer persisting in *Dermochelys* of the present time; that, in all other turtles, the outer has been wholly lost save a few ossicles in *Toxochelys*, while in the latter only vestiges of the inner covering have persisted. Such a development of an outer dermal covering is not impossible, as evidenced by osseous scutes overlying the dermal clavicles in certain lizards, yet one can hardly conceive of a condition in the early reptiles which would bring about the concurrent development of two coverings; certainly we have no warrant in calling the inner

carapace or any part of it "fascia bones"; they must certainly have arisen as purely dermal, membrane bones, and must have preceded the development of an outer layer. And one can not understand why such ossicles might not have developed, under the stress of peculiar environmental conditions, in the aquatic turtles after the loss of the true dermal carapace. Furthermore, this phylogeny seems yet to be based almost wholly on hypothesis, for we have little evidence of such a primitive condition, save that possibly afforded by the neural ossicles of *Toxochelys*. Here, too, it seems to the writer the argument is against the hypothesis, since the more specialized aquatic *Toxochelys* has the neural ossicles, while the nearly related, and less aquatic *Porthochelys* is without them.

The usual suborders, Cryptodira, Amphicheledia, Pleurodira and Trionychoidea are made superfamilies by the author, and, so far as the Trionychoidea are concerned at least, the writer agrees with him under any classification.

Dr. Hay recognizes the difficulty in deriving the turtles from any except the most primitive of reptiles; in other words, the order represents a phylum all its own in the evolution of the reptiles, a view first offered by Cope, with which the present writer is wholly in accord.

From his wide and accurate acquaintance with the literature of American fossil vertebrates it would be expected that little has escaped the author's attention; but he is not infallible. He expressly states that no fossil turtles are known from the Dakota Cretaceous, overlooking the fact that only a few years ago (1899) a very interesting specimen from that formation was described and figured by Parmenter in the *Transactions of the Kansas Academy of Science*; and it is to be regretted that he did not examine and describe the remains of a large marine turtle from the Benton of Kansas now in the University of Kansas Museum, to which attention was called six years ago by the present writer in the *Kansas University Quarterly*. However, such omissions will be found to be very rare in the work, and are not disquieting.

The illustrations are for the most part good, especially the text figures, of which there are over seven hundred. The Carnegie Institution is to be congratulated on the publication of this valuable and useful work.

S. W. WILLISTON

The Study of Stellar Evolution. By GEO. E. HALE. Pp. xi + 252; 104 plates; 7 text-figures. University of Chicago Press. 1908. Price, postpaid, \$4.27.

The past quarter of a century has witnessed a complete revolution in the conception of astronomy and of an astronomical observatory. The astronomy of twenty-five years ago was the science of position and of motion. The problems which then confronted the investigator were those concerning the size and shape of the planets, their distances from the sun, the periods of time in which they complete their orbits, and the discovery and explanation of the laws which govern their motions. The solution of these problems requires the precise measurement of the positions of the various bodies in the heavens at frequent intervals covering long periods of years. The old observatories were built and equipped with this end in view; the fundamental instruments were the meridian circle and the clock. The chief use of the equatorial was to measure the position of objects too faint to be seen with the meridian circle. Photography and spectrum analysis, as applied to astronomy, were beginning to obtain recognition, but were hardly regarded as the work of a "simon-pure" astronomer.

To-day this is changed; the astronomer is concerned not so much with the position and motions of the bodies, as with their physical characteristics; he wishes to know what they are, not where they are; from what they developed and what their future life history will be, rather than the exact path through space which they have traveled and are traveling. To solve these problems an astronomer to-day must be a physicist and a chemist, as well as a mathematician. The simple observatory of the past has become a great complex laboratory, in which the spectroscope of the phys-